Evaluation Report CCMC 13310-R
RigidLam® LVL

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1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "RigidLam® LVL", when used as a structural composite lumber (SCL) in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code 2010:

- Clause 1.2.1.1.(1)(a), Division A, using the following acceptable solutions from Division B:
  - Sentence 4.3.1.1.(1), Design Basis for Wood (CSA O86-09)

- Clause 1.2.1.1.(1)(b), Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
  - Sentence 9.23.4.2.(3), Spans for Joists, Rafters and Beams

This opinion is based on CCMC's evaluation of the technical evidence in Section 4 provided by the Report Holder.

Ruling No. 09-05-203 (13310-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on 2009-04-16 (revised on 2013-03-08) pursuant to s.29 of the Building Code Act, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

2. Description

The product is a laminated veneer lumber (LVL) that is manufactured by laminating 2.54-mm- or 3.175-mm-thick veneers of a single wood species or species combination that meets the requirements specified in the manufacturer's quality control manual and manufacturing standard. The veneers are laminated with the grain parallel to the length of the member using a phenol-formaldehyde adhesive.

The product is produced in thicknesses ranging from 31.75 mm to 44.45 mm and depths ranging from 89 mm to 610 mm. The 31.75-mm to 44.45-mm billets may be glued together to form up to 178-mm-thick beams.

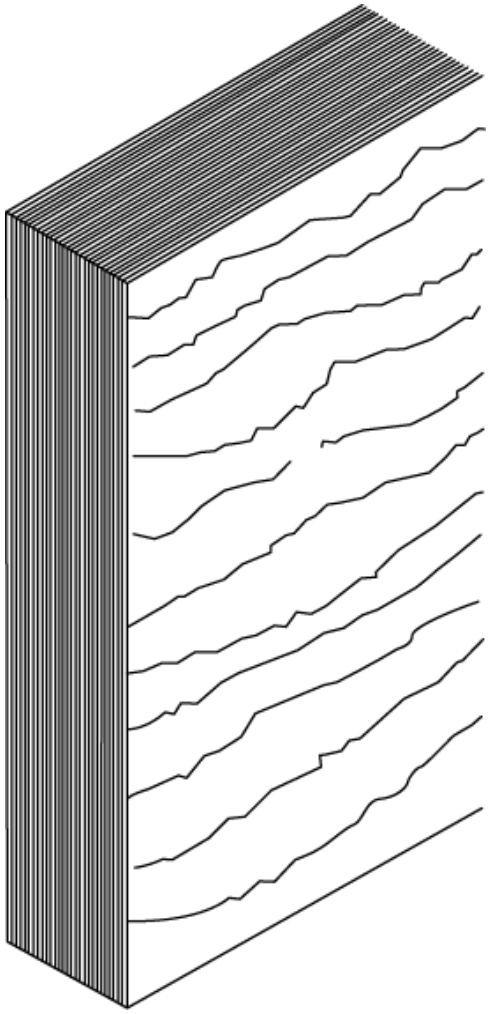

Figure 1. "RigidLam® LVL"

3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by the "RigidLam® LVL" being used in accordance with the conditions and limitations set out below.

- The product, as with all SCL, is intended for dry service applications only.[1]
- The product is intended for use in construction as an alternative material to lumber. Proprietary design values for the product are to be used by professional engineers to design in accordance with CSA O86-09, "Engineering Design in Wood," and Part 4, Structural Design, of Division B of the NBC 2010, for use in structural applications such as beams, headers, joists, rafters, and columns as intended by the product manufacturer. The specific application must be qualified through testing and validated by the manufacturer. Applications such as I-joist flanges, studs and metal-plated truss chords are beyond the scope of this Evaluation.
- The pre-engineered tables in the design guide listed below have been provided to CCMC by Roseburg Forest Products to demonstrate compliance with Part 9 buildings for acceptance by the local authority having jurisdiction (AHJ):

    i. *Roseburg Forest Products Design Guide*[2]
    When the product is used as a joist in simple and multiple spans supporting uniform loads only, the installation must be in accordance with the content of the Roseburg Forest Products' publication entitled, "Design Guide – Engineered Wood Products, Limit States Design," dated August 2012.
    The product must be installed in accordance with Roseburg Forest Products' installation guidelines noted in the document for those applications falling within the scope of the document. Applications outside the scope of the installation guidelines require engineering on a case-by-case basis.

    ii. *Roseburg's Installation Details*
    The product must be installed using nails and bolts in accordance with the manufacturer's size and spacing specifications.
    The ends of all the beams must be restrained to prevent rollover.
    The compression edges of all the beams must be continuously laterally supported.

iii. *Engineering Required*
For structural applications beyond the scope/limitations of the above-referenced Roseburg Forest Products' publication or when required by the AHJ, the drawings or related documents must bear the authorized seal of a professional engineer skilled in wood design and licensed to practice under the appropriate provincial or territorial legislation.
The product must be designed in accordance with the requirements of CSA O86 and Part 4 of Division B of the NBC 2010. The specified strengths and fastener limits for the product must not exceed the values set forth in Tables 4.1.1 and 4.1.2.
The engineer must design in accordance with CSA O86, and may use as a guide, the "Engineering Guide for Wood Frame Construction," published by the Canadian Wood Council.

iv. *Engineering Support Provided by Manufacturer*
Roseburg Forest Products provides engineering support for their product and may be consulted at:
www.roseburg.com
Tel.: (800) 347-7260
Fax: (541) 679-2612

Notes:

1 All lumber, wood-based panels and proprietary engineered wood products are intended for dry service conditions. "Dry service" is defined as the in-service environment under which the equilibrium moisture content (MC) of lumber is 15% or less over a year and does not exceed 19% at any time. Wood contained within the interior of dry, heated or unheated buildings has generally been found to have a MC between 6% and 14% according to season and location. During construction, all wood-based products should be protected from the weather to ensure that the 19% MC is not exceeded in accordance with Article 9.3.2.5., Moisture Content, of Division B of the NBC 2010.

2 The pre-engineered tables present the pre-engineered factored resistance of the beam. The AHJ may require further engineering to determine the factored load in accordance with Part 4, Structural Design, of Division B of the NBC 2010.

4. Technical Evidence

The Report Holder has submitted technical documentation for CCMC's evaluation. Testing was conducted at laboratories recognized by CCMC. The corresponding technical evidence for this product is summarized below.

4.1 Design Requirements

Table 4.1.1 Specified Strengths (MPa) and Modulus of Elasticity (MPa)[1] of the Product

Property		Grade 1.5E	Grade 1.8E	Grade 2.0E	Grade 2.2E
Bending (edge loading)[2], f_b		28.67	33.13	39.50	43.32
Bending (plank loading)[3], f_b		25.71	33.13	39.50	43.32
Tensile (parallel to grain)[4], f_t		15.98	18.11	22.38	25.84
Compressive (parallel to grain), f_c		21.46	26.41	33.01	35.21
Compressive (perpendicular to grain), f_{cp}:	**parallel to glue line (beam)**	7.22	8.79	9.41	10.67
	perpendicular to glue line (plank)	5.46	5.46	5.46	6.28
Horizontal shear, f_v:	**perpendicular to glue line (beam)**	2.82	3.59	3.72	4.16
	parallel to glue line (plank)	1.37	1.54	1.54	1.52
Modulus of elasticity[5], E:	**edge bending**	10 340	12 410	13 790	15 170
	plank bending	10 340	12 410	13 790	15 170

Notes to Table 4.1.1:

1 The values are in accordance with CSA O86.

2 The specified edgewise bending strength, f_b, is based on a standard depth of 305 m. For other depths, multiply by $K_{zb} = (305/d)^{1/8}$, where d = depth (mm). For depths less than 89 mm, multiply by $K_{zb} = 1.166$.

3 The specified plankwise bending strength, f_b, is based on a standard thickness of 44.5 mm. For thicknesses exceeding 44.5 mm, multiply by $K_{zb} = (44.5/t)^{1/5}$, where t = thickness (mm). For thicknesses less than 44.5 mm, multiply by $K_{zb} = 1.0$.

4 The specified tensile strength, f_t, is based on a standard length of 6 096 mm. For other lengths, multiply by $K_{zt} = (6\,096/L)^{1/9}$, where L = length (mm). For lengths less than 1 220 mm, multiply by $K_{zt} = 1.196$.

5 For uniformly loaded simple span beams, the deflection must be calculated as follows:

$\Delta = 5wL^4/384\ EI$

where:
Δ = deflection (mm)
w = specified uniform load (N/mm) L = span (mm)
E = modulus of elasticity (MPa)
I = moment of inertia = $bd^3/12$ (mm^4)

Table 4.1.2 Relative Density (or Specific Gravity) for Fastener Design for the Product

Veneer Species	LVL Grade	Nails				Bolts[1]
		Lateral Loads		Withdrawal Loads		Lateral Loads
		Face[2]	Edge[2]	Face	Edge	Face[2]
Douglas-fir	1.5E	0.50	0.50	0.50	0.50	0.47
	1.8E	0.50	0.50	0.50	0.50	0.50
	2.0E	0.50	0.50	0.50	0.50	0.50
	2.2E	0.50	0.50	0.50	0.50	0.50

Notes to Table 4.1.2:

1 For 12.7-mm or 19.1-mm bolts.

2 Load direction perpendicular to and parallel to the grain.

Table 4.1.3 Nail Spacing[1] – Installed Parallel to the Glue Line

Product Thickness	Nail Type and Size	Minimum Nail Spacing[2] [3] (mm)	Nail End Distance[2] (mm)
Less than 38 mm	8d box	76.2	38.1
	8d common	76.2	50.8
	10d and 12d box	76.2	50.8
	10d and 12d common	101.6	76.2
	16d sinker	101.6	76.2
	16d common	152.4	101.6
38 mm and greater	8d box	50.8	25.4
	8d common	76.2	50.8
	10d and 12d box	76.2	50.8
	10d and 12d common	101.6	76.2
	16d sinker	101.6	76.2
	16d common	152.4	76.2

Notes to Table 4.1.3:

1 Table 4.1.3 is based on a minimum member depth of 88.9 mm when nailing into the narrow face of the material, parallel to the glue line.

2 Spacing and end distances apply to single rows of nails.

3 The minimum allowable edge distance is 6.35 mm.

This Evaluation Report is applicable only to this product when labelled with the APA EWS certification mark and the phrase "CCMC 13310-R" on each member.

The manufacturing quality assurance program has been adapted to include requirements specified in ASTM D 5456-07, "Standard Specification for Evaluation of Structural Composite Lumber Products," and is verified by APA-The Engineered Wood Association as part of the product certification. APA-The Engineered Wood Association conducts monthly audits of the manufacturing plants and the quality assurance program.

Report Holder

Roseburg Forest Products Co.
10599 Old Highway 99 South
Dillard, OR 97432-0288
U.S.A.

Telephone: 541-679-3311
Fax: 541-784-2593

Plant(s)

Riddle, OR, U.S.A.

Disclaimer

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2015-01-13

Appendix A

The design values specified in this Report were obtained from testing in conformance with ASTM D 5456-07 and are summarized below. The manufacturer's published pre-engineered beam and header spans were designed in accordance with CSA O86-09.

Table A1. Additional Test Information for "RigidLam®LVL"

Property	Test Information
Bending	Specimens were tested in edge and plank bending to establish the characteristic value and volume adjustment exponent. Qualification test data was used to establish the applicable coefficient of variation, CV_W, and the reliability normalization factor from CSA O86 was used to determine the specified strength.
Shear	Specimens were tested in shear to establish the characteristic value. Qualification test data was used to establish the applicable coefficient of variation, CV_W, and the reliability normalization factor from CSA O86 was used to determine the specified strength.
Compression parallel to grain	Specimens were tested to establish the characteristic value. Qualification test data was used to establish the applicable coefficient of variation, CV_W, and the reliability normalization factor from CSA O86 was used to determine the specified strength.
Compression perpendicular to grain	Specimens were tested in edge and plank compression to establish the characteristic value. The characteristic value was multiplied by 1.09 to establish the specified strength in accordance with CSA O86.
Tension parallel to grain	Specimens were tested to establish the characteristic value and volume adjustment exponent. Qualification test data was used to establish the applicable coefficient of variation, CV_W, and the reliability normalization factor from CSA O86 was used to determine the specified strength.
Nail withdrawal	Nail withdrawal values were established following ASTM D 1761-06, "Standard Test Methods for Mechanical Fasteners in Wood," for an 8d common nail having a 38-mm penetration. Specimens were tested and an equivalent species capacity was determined in accordance with ASTM D 5456-01, A2.
Nail bearing	Nail bearing strength was determined in accordance with ASTM D 5764-97a(2007), "Standard Test Method for Evaluating Dowel-Bearing Strength of Wood and Wood-Based Products," with 10d common nails with a nominal diameter of 3.76 mm. Specimens were tested and the mean bearing capacity was used to establish the equivalent species capacity as per ASTM D 5456-01, A2.
Bolt bearing	Bolt bearing capacity was determined in accordance with ASTM D 5764 with 13-mm and 19-mm bolts. Specimens were tested and the mean bolt bearing capacity was used to establish the equivalent species capacity in accordance with ASTM D 5456-01, A2.
Creep and recovery	The SCL specimens were subjected to a 90-day creep test for duration of load for verification of equivalency to lumber in accordance with the principles of ASTM D 6815-09, "Standard Specification for Evaluation of Duration of Load and Creep Effects of Wood and Wood-Based Products." The criteria were met and the specimens deemed equivalent to lumber.
Adhesive	The phenol-formaldehyde adhesive complies with CSA O112.6-M1977, "Phenol and Phenol-Resorcinol Resin Adhesives for Wood (High Temperature Curing)."